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ABSTRACT

These two bulletins were developed for the Calculator Information Center. "Motivating Activities for Low (and Higher) Achievers," prepared by Don Miller, presents activities that suggest ways in which a calculator can be used to help reinforce or develop certain mathematical ideas. Included are sections with activities for numeration, mental computation, number patterns, estimation, and problem solving. "Solve It with a Calculator," prepared by Earl Ockenga and Joan Duea, focuses on experiences for using the calculator to develop skill in solving problems. The problems have been selected to appeal to various ages and abilities. Students may use such strategies as make a guess and check, choose the operation, or look for the pattern. (MNS)

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SE040359

Motivational Activities For Low (And Higher) Achievers

Prepared by Don Miller

Trying to find ways to help students who lack mental, estimation, or problem-solving skills has long been a goal of teachers. The reasons for these deficiencies are many, but the lack of motivation to learn mathematics is often the cause. It is here that the calculator can serve as a valuable classroom aid, since it is generally true that even the most "reluctant" learner likes to use a calculator.

The activities that follow suggest several ways in which a calculator can be used to help reinforce or develop certain mathematical ideas. All of the exercises can easily be changed or extended to meet the needs of students at any grade or ability level.

Activities for Numeration

1. Show these numbers on your calculator:

   8 tens 16 ones

   4 hundred 25 tens 6 ones

2. Try to get the correct sum by adding the following.

   nine hundred five

   six thousand eight

   four thousand twenty three

   seventy thousand sixty

   SUM 80996

   twenty-five thousands

   six ten thousands

   twelve hundreds

   seventeen tens

   SUM 86370

3. You can get a calculator to show 342 by finding the sum 300 + 40 + 2. Try doing this to get the numbers below.

   6074 39602 348.49 607.023

4. | 17643 | 3769 | 2935 | 5013 | 793 |
   |---|---|---|---|---|

   Add the numbers which have 7 in the hundreds place.

   Subtract the smallest number from the largest.

   Find the sum of the numbers between 2000 and 5000.

5. Enter the start number and then use addition or subtraction to get your calculator to show each of the other numbers in order.

   START

   123456 → 120456 → 120406 →
   127406 → 27406 → 7406 →
   7456

   123.456 → 120.456 → 120.406 →
   100.406 → 100.409 → 0.409 →

6. What did Orville say when he saw his girl friend flying an airplane? Solve the problem below. Then flip your calculator and read the answer.

   Enter 56785.612

   Add 3 to the thousands place

   Subtract 3 from the tenths place

   Subtract 8 from the tens place

   Add 3 to the hundredths place

   Subtract 9 from the thousands place

   FLIP UPSIDE DOWN AND READ THE ANSWER

Activities for Mental Computation

Many people are concerned that the use of calculators in schools will result in students lacking mental arithmetic skills. This concern may be warranted if the calculator is used merely as a device to find or check answers. However, with appropriate activities and teacher supervision, a calculator can serve as a very effective tool to help develop and reinforce mental skills.

Many simple calculators have a built-in constant feature which allows for a variety of activities which can be used to improve these skills. Students familiar with this feature can use it to develop their mental capabilities at home as well as in the classroom. Maximum results from this type of activity will only be realized if students commit themselves by making a guess before each answer appears on the display.

1. Counting up.

ENTRIES	DISPLAY			
6 + = = = . . .	6	12	18	24 . . .
0.5 + = = = . . .	0.5	1	1.5	2 . . .

a) Get the calculator to count up by numbers of your choice.

b) Use your counting skills to fill in the missing numbers MENTALLY. Check with a counting calculator.

12, 24, 36, ____, ____, ____, ____, ____, ____, ____, ____, ____, ____, ____

____, ____, ____, ____, 1.25, 1.50, 1.75, ____, ____, ____, ____, ____

2. Counting down.

ENTRIES	DISPLAY	
100 - 5 = = = . . .	100 90	95 85 . . .
25 - 0.5 = = = . . .	25 24	24.5 23.5 . . .

a) Get your calculator to count down by numbers of your choice. Try to guess the answers before you push the equals key and they appear on the display.

b) Try to guess what your calculator will show in each problem.

1000 - 25 $\underbrace{= = \ldots =}_{\text{15 times}}$?

9 + $\underbrace{= = \ldots =}_{\text{22 times}}$?

Activities for Number Patterns

Number patterns can be a very effective way to introduce or reinforce many important mathematical skills and ideas. The calculator provides students with a powerful tool that can easily generate data which allows them to focus their attention on discovering patterns and making generalizations rather than on doing lengthy computations.

1. Use a calculator to find the answers until you discover a pattern. Then try to complete the others MENTALLY.

a) 3 ÷ 10 7 ÷ 10 3 ÷ 100 39 ÷ 100
132 ÷ 1000 172 ÷ 10000

b) 57 x 10 7.5 x 100 0.46 x 1000
870 x .01 34.6 x .001 0.0045 x 100

c) 49 x 51 48 x 52 47 x 53 46 x 54
78 x 82 35 x 45 295 x 305

2. Complete the first table with a calculator[C]. Look for a pattern in the answers and then try to complete the other table MENTALLY[M].

a) [C]

X	16	45	24	99	75	37
201						

[M]

X	22	49	62	89	73	8
201						

b) [C]

X	33	333	66	666	999
37					

[M]

X	3333	99	666666	9999
37				

c) [C]

1% of 300 = _____
2% of 300 = _____
3% of 300 = _____
7% of 300 = _____
10% of 300 = _____
20% of 300 = _____

[M]

1% of 800 = _____
6% of 800 = _____
20% of 800 = _____
30% of 600 = _____
7% of 400 = _____
15% of 300 = _____

3. $11^2 = 121$, $111^2 = 12321$, $1111^2 = 1234321$ and $11111^2 = 123454321$

Based on the above pattern one might guess that the answer of 111111111^2 is 12345678987654321. Use a calculator to do simple problems that might help you guess an answer to each of the following.

a) 3333333333^2 b) 101 x 12222222222

4. Use a calculator to find out what pattern results when:

a) 37 is multiplied by a multiple of 3.

b) a two-digit number is divided by 99. by 999. by 9999.

c) a three-digit number is multipled by 13 and 77 (e.g., 123 x 13 x 77)

d) a number is divided by 0. by 10. by 100. by 1000.

e) a number is multiplied by 9. by 99. by 999. by 99999.

Activities for Estimation

The fact that numerous everyday situations call for an estimate leaves little doubt that some degree of proficiency in making reasonable guesses should be expected of students at all ability levels. The activities below suggest a few of the many ways in which a calculator might be used to develop estimation skills. Remember that improvement in this area cannot be expected unless students are required to make an estimate before using a calculator.

1. Estimate each answer, rounding off as indicated.

a) hundreds: 4097 + 706 + 24 + 567 + 6164 ⟶ 11600 (estimate)

b) tens: 32.6 + 68.4 + 238.7 + 67.8 ⟶ 410 (estimate)

2. $<$, $=$, or $>$? Estimate. Then check.

$427 + 54 \square 39 + 437$

$(72 \times 39) \div 29 \square 145$

$58 \times 32 \square 116 \times 15$

$\frac{5}{7} \square 0.8$

3. Circle the largest number which results in a true statement.

a) $37 \times (40 \quad 50 \quad 60 \quad 70) < 2195$

b) $1386 \div (6 \quad 7 \quad 8 \quad 9) < 191$

4. Try to estimate the missing digits. Then check.

$139 + 56 + 387$	34×69
$\square 8 \square$	$\square 34 \square$

$1026 \div 38$	38^2
$\square 7$	$\square 44 \square$

94×37	$\square\square^2$
$\square 47 \square$	1764

5. Use the multiplication problem shown below along with your estimation skills to help you estimate the missing numbers. Then check.

$$\begin{array}{r} 783 \\ \times\ 354 \\ \hline 3132 \\ 39150 \\ 234900 \\ \hline 277182 \end{array}$$

a) $783 \times$ _____ $= 391.50$

b) $40 \times 7.83 =$ _____

c) _____ $\div 30 = 7.83$

d) $78.3 \times 3.54 =$ _____

6. True or false? Make your decision using estimation. Then check. Correct each false statement by changing the underlined number.

a) 8031 exceeds 3978 by 5953.

b) Twice 489 increased by 247 is 1225.

c) A sports store bought 48 baseballs at \$3.99 each and 88 jerseys at \$7.50 each. The total bill was \$979.20.

7. Circle the number which you think will make the statement true.

a) A rectangular field of width 19 meters and perimeter [63 100 151] meters has an area of 589 square meters.

b) If Jim bought 2 shirts at \$6.98 each and 3 pairs of socks at \$1.75 per pair, he would get [\$2.76 \$0.79 \$1.17] change from \$20.

8. Try to decide whether the given estimate is reasonable. If not, write your estimate. Then find the actual answer with a calculator.

A factory machine produces 14 items in 3 minutes. At this rate, how long will it take the machine to produce 1862 items? Kim's estimate: 2 hours.

9. Circle the numbers that you think will get you within 2 of the target number. Then check.

a) 87 51 65 43

(O + □) ÷ 8 ⟶ 20

b) 14 82 69 58

O x (□ — △) ⟶ 754

10. Use a calculator along with your estimation skills to help you find the missing digits in each problem below.

a) 67 x 4□ x 12 = 3□□76

b) 31□2 ÷ 4□ = 76

c) 27 x □1 — 8□ =829

d) (756 ÷ □□) x 58 + 399 = 1617

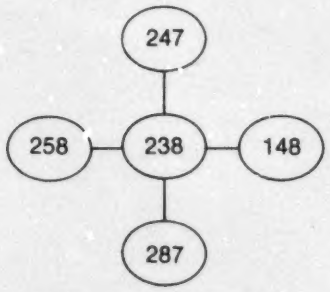
11. ONE-PLAYER TIC-TAC-TOE. To win you you must get three in a line before your calculator gets three squares any place on the board. Pick a square and guess the answer. Check with a calculator. Mark an **X** if correct. Mark a **C** for the calculator if your guess was not correct.

Guess the Best Answer

32.1 x 7.8 190 250 290	4.3 x 29.8 90 130 190	2819 ÷ 46 39 61 71 76
21.7 + 35.6 + 79.2 14 94 140 190	.064 x 54.5 34 340 3.4 .34	367.4 ÷ 27.6 — 198.7 20 70 200 600
.84 x 7.95 3 6 .56 64	762 x 6.45 420 4200 4800	128.72 ÷ 3.8 20 40 200

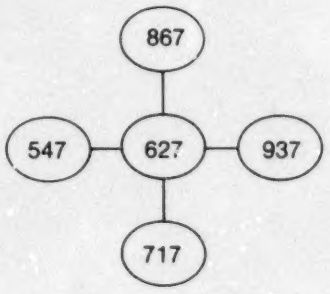
12. THREE-IN-A-LINE. The answers to the problems are shown in the circles. Your goal is to find the three problems which will give three answers in a straight line. All problems must be done using your mental or estimation skills. Then use a calculator to check.

a)



- One half of 184 increased by 56
- The number of yards in 741 feet
- The number of days in 34 weeks
- The smallest of two consecutive numbers whose sum is 575
- The number which is 642 less than the square of 30

b)



27 x 52 — 687
19 x 34 + 291
32 x 39 — 381
37 x 23 — 224
23 x 16 + 179

13. ESTIMATION CARD GAMES (2 to 4 players)

- Each player needs a set of nine numbered cards ([1], [2], [3], . . . , [9]).
- Each player needs a problem card (e.g., □□ ÷ □ ⟶ □).
- Another set of nine numbered cards is mixed and placed face down.

Rules

- Turn over as many numbered cards as there are empty squares on the problem card. The first card turned over is always the target number.
- The players then decide where to place each number on their problem cards.
- After a set time limit a calculator is used to check the answers.
- The "best" answer scores one point. One point is given each player on ties.
- The first player to score six points wins the game.

Suggested below are a few of the many types of problem cards that can be used at different age and ability levels.

□□ ÷ □ ⟶ □ □□□ ÷ □□ ⟶ □

(□□ + □□) ÷ □ ⟶ □

$\square\square^2 - \square\square \longrightarrow \square$ $\sqrt{\square\square} \longrightarrow \square$

200 < □□□ − □□□ < 300

30 < □□□□ ÷ □□ < 60

□□□ x □□ ⟶ smallest possible number

□□□□ ÷ □ ⟶ whole number

Activities for Problem Solving

Many students experience almost total frustration when it comes to problem solving. Not having mastered computational algorithms is often the cause. This deficiency frequently perpetuates the difficulty since most of the time is spent on computational drill rather than on developing problem-solving skills. Here the calculator can serve as a motivational tool by allowing students finally to realize some success with problem solving while also alleviating the frustration caused by computational difficulties. The ease with which a calculator handles large or "messy" numbers will also allow students to solve more realistic and interesting problems.

1. How big is one billion?
   a) How long would it take you to spend $1 billion at a rate of $75 per second, if you don't stop to eat or sleep?
   b) A $1 bill has dimensions which are about 2⅝ in. by 6⅛ in. How many miles of a highway 30-feet wide could be covered by one billion $ bills?
   c) One billion dollars distributed equally to every person in North Dakota would give each person about $1620.75. What is the population of North Dakota? How much would each person in your state get?

2. Peanut prices:

Brand A	Brand C
$0.60/lb.	$0.98/lb.
Brand B	Brand D
$0.72/lb.	$1.38/lb.

Imagine that you are a store manager and you want to mix a batch of peanuts such that the selling price is between 85 and 90 cents. Find at least two ways to mix 100 pounds if you want to have at least 15 pounds of each brand in the batch.

3. Find the message. Use a calculator to find the missing numbers. Then write the given letter above the number to find the message.

908		594	248		
598	588	675		594	598
		P			
439	268	678	439	178	608

$$\begin{array}{r} 839 \\ +\boxed{678} \\ \hline 1517 \end{array}\ \text{P}$$

$$\begin{array}{r} 674 \\ \square \\ +\ 476 \\ \hline 1738 \end{array}\ \text{O}$$

$$\begin{array}{r} 76 \\ \times\ 38 \\ \hline \square \\ 2280 \\ \hline 2888 \end{array}\ \text{T}$$

$$\begin{array}{r} 1021 \\ -\ \square \\ \hline 423 \end{array}\ \text{N}$$

$$\begin{array}{r} 23 \\ \times\ \square \\ \hline 6164 \end{array}\ \text{X}$$

$$\begin{array}{r} \square \\ -\ 369 \\ \hline 539 \end{array}\ \text{I}$$

$$\text{M}\quad \square\ \text{r}\ 13 \quad \big)\, 3485 \quad (14)$$

$$\text{R}\quad 46\ \text{r}\ 7 \quad \big)\, 8195 \quad (\square)$$

$(19 \times 24) + 138 = \square$ A

$871 - (24 \times 18) = \square$ E

$$23\ \text{r}\ 8 \quad \big)\, \square \quad (29)\ \text{W}$$

This bulletin was prepared by Don Miller, St. Cloud State University, St. Cloud, Minnesota.

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Solve It With A Calculator

Information Bulletin No. 14
January 1983

CALCULATOR INFORMATION CENTER

1200 Chambers Rd.
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SE040359

SOLVE IT WITH A CALCULATOR

Compiled by Earl Ockenga and Joan Duea

The activities that follow focus on experiences for using the calculator to develop skill in solving problems. The problems have been selected to appeal to students of various ages and abilities. Students may use strategies such as make a guess and check, choose the operation, or look for the pattern.

The problems contained within this bulletin were selected from "Problem Solving Using the Calculator, Book 1" and "Problem Solving Using the Calculator, Book 2," Project Impact, Price Laboratory School, University of Northern Iowa, Cedar Falls, IA 50613.

ANSWERS:

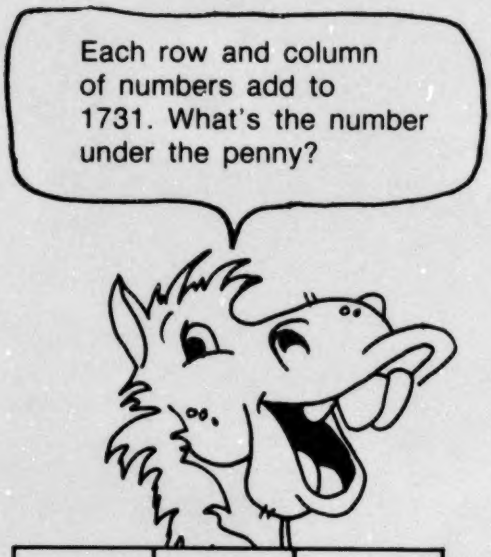
Sum Sense 703
Switch It 20 ⊞ 22 ⊟ 24 ⊞ 26 ⊟
Weigh In 67
Time Out 12
Can You Find It? 5
Side-by-Side 44, 45, 46
Make It Big 74 ⊠ 65
What's My Number? 66
Sum Pairs 25 ⊠ 25
Open and Shut 36, 37
What Is It? 1666
Make It Small 246 ⊠ 35

Which Does Not Belong? $\frac{1047}{1745}$

Can You Spot It? (3267 × 7) ÷ 3
(4356 × 6) ÷ 4
(5445 × 5) ÷ 5
(6534 × 4) ÷ 6
(7623 × 3) ÷ 7

Make It Simple 927
Check It Out $6.15
Mystery Number 63
Small Times 0.0046476
Look For It 0.0001001 (Any number smaller than 0.0002 is very good.)
Decimal Hunt 99,999
Push It 9999 ⊠ ⊟
Date It 1968
Who Knows 100,000,000
Check the Remainder 11 numbers

Sum Sense



766	325	640
451	577	
514	829	388

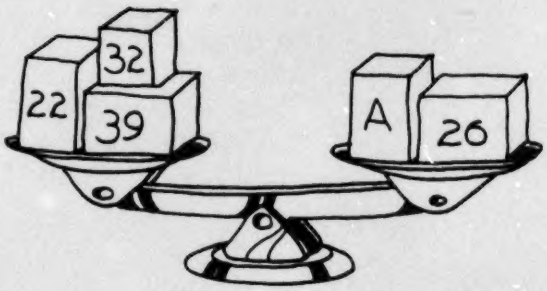
Switch It!

Change one of the ⊞'s to ⊟ to get an answer of 44.

20 ⊞ 22 ⊞ 24 ⊞ 26 ⊟

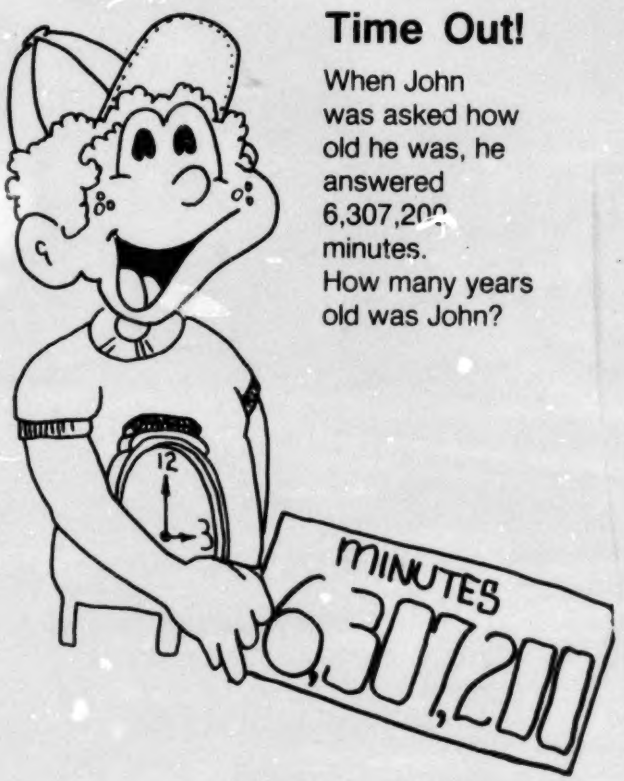
Weigh In

What is the weight of Box A?



Time Out!

When John was asked how old he was, he answered 6,307,200 minutes. How many years old was John?



Can You Find It?

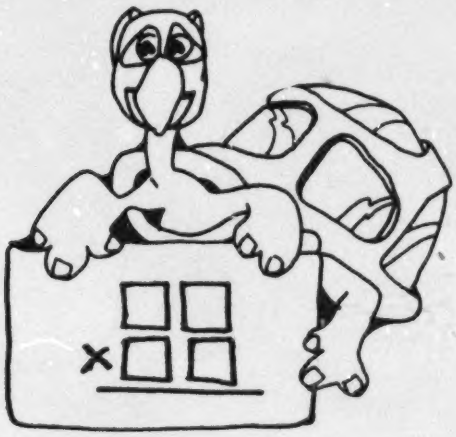
What is the missing number?

Side-By-Side

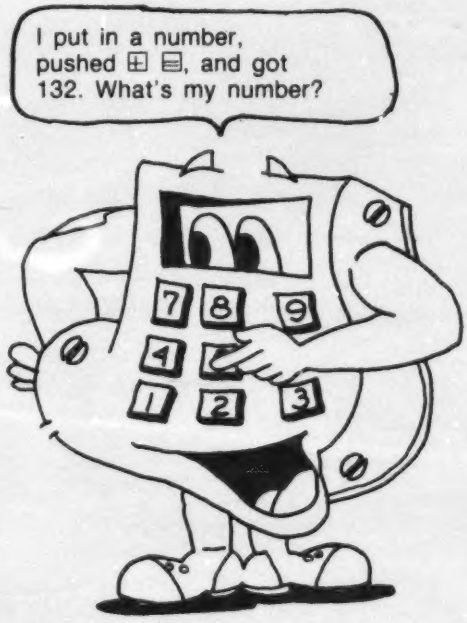
What 3 side-by-side lockers have numbers that add to 135?

Make It Big!

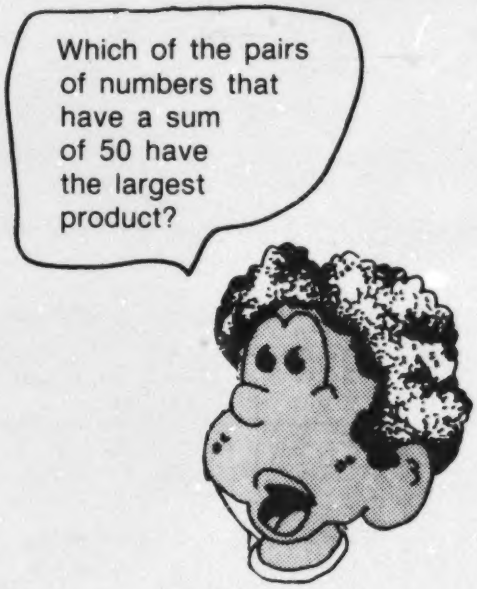
Put 4, 5, 6, and 7 in the □'s to get the largest possible answer. Use each digit only once.



What's My Number?



Sum Pairs

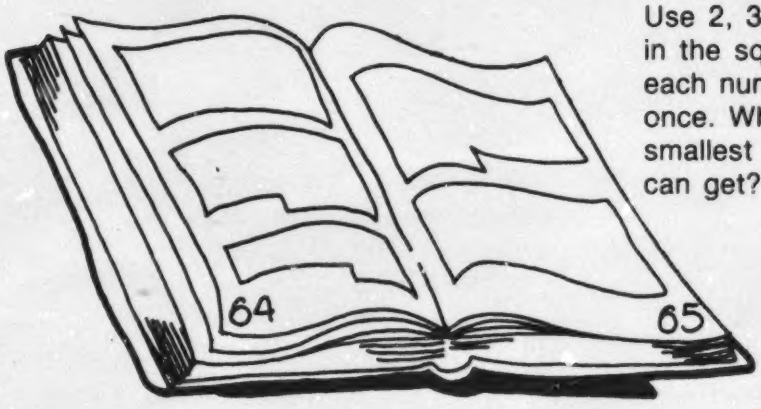


What Is It?

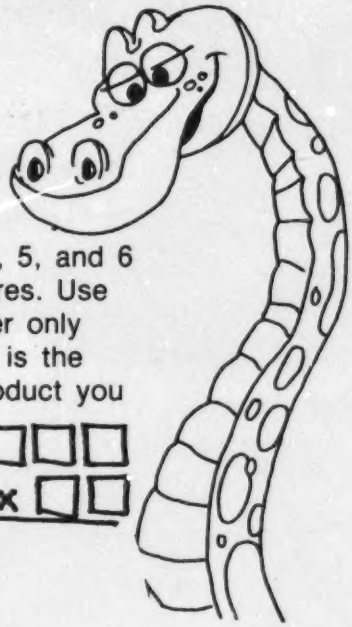
What is the largest whole number that can be multiplied by 6 to get a product that is less than 10,000?

Open And Shut

The product of these two page numbers is 4160. Where would you open the book so the product of the page numbers is 1332?



Make It Small!

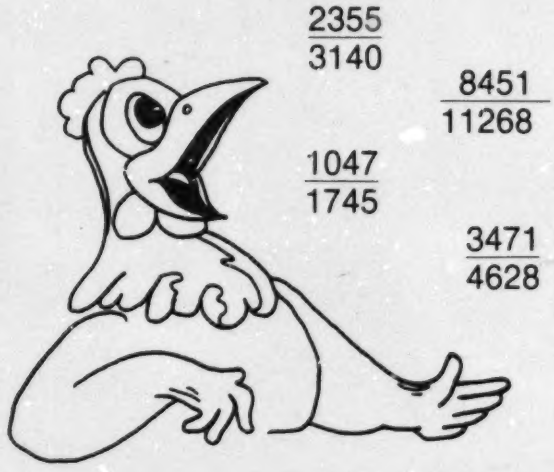


Use 2, 3, 4, 5, and 6 in the squares. Use each number only once. What is the smallest product you can get?

□□□
x □□

Which Does Not Belong?

One of these fractions does not belong. Which one is it?



$\frac{2355}{3140}$ $\frac{8451}{11268}$ $\frac{1047}{1745}$ $\frac{3471}{4628}$

Can You Spot It?

Look for the pattern.
Fill in the blanks.

(1089 × 9) ÷ 1 = 9801
(2178 × 8) ÷ 2 = 8712
(____ × _) ÷ _ = 7623
(____ × _) ÷ _ = 6534
(____ × _) ÷ _ = 5445
(____ × _) ÷ _ = 4356
(____ × _) ÷ _ = 3267

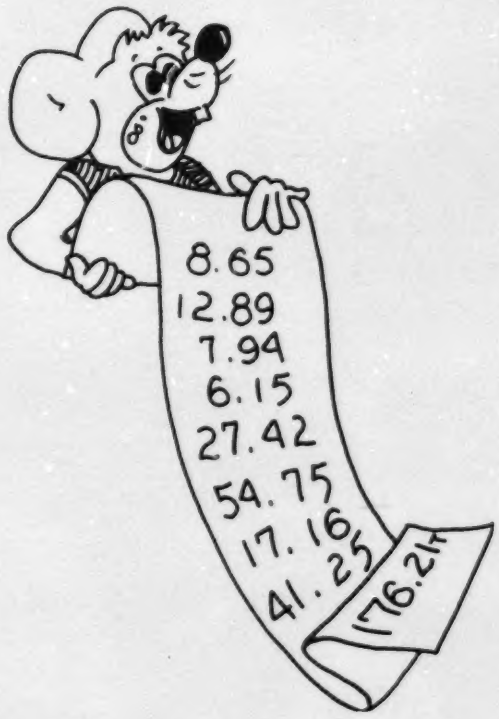
Make It Simple!

How many times would you subtract 37 from 34,315 to display a number less than 37?

Check It Out

This is my cash register tape for one day.

At the end of the day I found only $163.91 in cash. One of the numbers was added when it should have been subtracted. Find the number.



Mystery Number

I'm thinking of a number less than 100. When I divide it by 9 the remainder is 0.

But look what happens when it is divided by 8.

What number am I thinking of?

Small Times

What is the smallest number **N** you can enter in this code and display a number greater than zero on your calculator?

N ⊠ ⊟ ⊟

Look For It!

What is smallest number **N** you can enter in this code and display a whole number?

Decimal Hunt

Push It

Find a way to push only 6 keys on your calculator to display 99980001.

Date It!

In what year was I born?

The year is evenly divisible by 24, 41, and 48.

Who Knows?

How many counting numbers can be displayed on an 8-digit calculator?

Check The Remainder

How many whole numbers between 1 and 100 give a decimal part of .22222 ... when you divide by 9?

This bulletin was prepared by Earl Ockenga and Joan Duea, University of Northern Iowa, Cedar Falls, Iowa.

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